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Impact of Sociodemographic, Environmental and Lifestyle factors on Tuberculosis Patients: A Case Study from Patiala (Punjab)

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Abstract
Tuberculosis (TB) remains a major public health concern in low- and middle-income countries, including India, where social, lifestyle and environmental conditions strongly influence disease transmission and clinical presentation. The present study aimed to assess the clinical symptom profile and sociodemographic characteristics of TB patients in Patiala, Punjab, with particular emphasis on age, lifestyle habits and selected environmental factors. A cross-sectional survey was conducted among 100 TB patients attending outpatient departments of three hospitals in Patiala. Data on sociodemographic variables, lifestyle factors and clinical symptoms were collected through face-to-face interviews using a structured questionnaire. Out of the 100 participants, 44% were older than 45 years, 58% resided in urban areas and 54% were female. Chest pain ($p = 0.020$), shortness of breath ($p = 0.015$) and night sweats ($p = 0.003$) were significantly more prevalent in older patients. Chest pain showed a significant association with smoking ($p = 0.03$) and alcohol consumption ($p = 0.003$). Living in crowded conditions was significantly associated with cough ($p = 0.013$), highlighting the role of environmental exposure in early respiratory manifestations. The findings suggest that the severity and pattern of TB symptoms are influenced by age, lifestyle habits and environmental conditions such as crowding. Incorporating environmental and sociodemographic risk assessment into TB control strategies may facilitate early diagnosis and improve patient-centred management.

Keywords: Alcohol; Clinical symptoms; Environmental factors; Smoking; Sociodemographic profile; Tuberculosis

Introduction

Tuberculosis (TB), caused by Mycobacterium tuberculosis, remains one of the most prevalent infectious causes of serious illness and death worldwide. It till affects about 10 million people per year and results in over 1.6 million deaths, despite being preventable and curable. (WHO 2025). Low- and middle- income nations bear a disproportionately heavy burden, India alone accounts for roughly one-fourth of all cases worldwide (Smith et al., 2021; CTB 2024).

TB primarily involves the lungs but may affect other organs such as the lymph nodes, kidney, bones and brain (Sharma and Mohan, 2020). It is transmitted by airborne droplets from people who have active pulmonary tuberculosis. The infection ranges from latent TB infection (LTBI) and active disease, which presents with persistent cough, fever, weight loss and night sweats (CDC, 2025; Kumar et al., 2022). Sociodemographic factors including age, gender, education and occupation significantly influence TB exposure, clinical presentation and treatment outcomes (Gupta et al., 2021; Lonnorth et al., 2019). In addition, environmental determinants such as household crowding, housing quality and access to healthcare services play a critical role in shaping TB transmission dynamics and disease severity.

Understanding these interactions at the local level is essential for improving early detection and targeted public health interventions. Punjab, a northern Indian state, presents a unique TB epidemiological profile influenced by urban–rural heterogeneity, population mobility and variable access to health services (Govt. of Punjab, 2023; Singh et al., 2023). Patiala district, with its mixed urban and rural population and diverse socioeconomic structure, offers an appropriate setting to examine the interplay between clinical, sociodemographic and environmental determinants of TB. The present study therefore aimed to document the clinical symptom profile and sociodemographic characteristics of TB patients in Patiala and to analyse variations in symptoms across age groups, lifestyle habits and selected environmental factors.

Subjects and Methods

Study Design

The present study was a cross-sectional, questionnaire-based survey conducted in Patiala city, Punjab, to assess the socio-demographic and clinical symptom profile of tuberculosis (TB) patients. The survey was carried across three healthcare institutions—Aggarwal Hospital, Manipal Hospital, and Rajindra Hospital. These hospitals were selected to ensure inclusion of patients from diverse socioeconomic and demographic backgrounds, thereby improving the representativeness of the study population.

Sampling

A total of 100 TB patients were included in the study. Participants were selected through convenience sampling from the outpatient departments (OPDs) of the selected hospitals. Both male and female patients diagnosed with TB were eligible for inclusion. Patients who were unwilling to respond or critically ill were excluded from the study. To ensure unbiased responses, participants were not pre-informed about the survey's objectives prior to data collection. Each respondent provided verbal consent before participation.

Data Collection

Data were collected using a structured questionnaire designed to record:
Personal Information: Age, gender, residence and education level.
Lifestyle and Habits: Smoking and alcohol consumption.
Clinical symptoms: Cough, sputum production, hemoptysis, fever, night sweats, fatigue, chest pain, weight loss, and lymph node swelling.
Face to face interviews were conducted in the local language to ensure clarity and accuracy of responses.

Statistical Analysis

Data was analysed using SPSS statistic v26.0 Categorical variables were summarized as frequencies and percentages. Associations between clinical symptoms and factors such as smoking, alcohol use and age groups were assessed using the Chi- square test. A p value < 0.05 was considered statistically significant.

Ethical Considerations

Permission to conduct the study was obtained from the respective hospital authorities. Participants were assured that their responses would be used solely for research purposes, and their identities would remain confidential.

Results

Sociodemographic characteristics

Among the 100 TB patients that were surveyed, females made up a slightly higher percentage (54%) than males (46%). Of the participants, 58% lived in urban regions and 42% in rural areas. The disease was most prevalent in people over 45 years of age (44%), followed by those between the ages of 31 and 45 (32%), suggesting that middle-aged and older populations were more affected. In terms of education, 10% has graduated, 46% had finished secondary school, and 22% had only completed primary school or were illiterate. Overall, the demographic distribution indicated that middle-aged, urban and somewhat educated people were more likely to be impacted by tuberculosis as shown in table 1.

Clinical Symptom Profile

Prevalence of clinical symptoms among the TB patients surveyed is represented in table 2. The most commonly reported systemic symptoms were fatigue (92%) and fever (90%), followed by cough, night sweats, and weight loss (each 84%). Shortness of breath (76%) and chest pain (68%) were prevalent respiratory symptoms, and 66% of patients reported having sputum. Hemoptysis (20%) and swollen lymph nodes (46%) were less common but clinically significant markers of disease progression. Collectively, these results show that TB in this group was marked by both systemic and respiratory symptoms, indicating broad pulmonary involvement and overall systemic impairment.

Severity of symptoms with relation to residence

The study reported the frequency of sputum production was considerably higher in rural patients compared to urban patients (Table 3). Similarly, there was a significant correlation between residence and haemoptysis with rural patients reporting it more frequently. The prevalence of other symptoms like chest pain, shortness of breath ad fever was also reported higher in rural patients. This could be due to higher burden of respiratory and systemic symptoms due to delayed health-seeking behaviour or restricted access to facilities for diagnosis and treatment that might have resulted in advanced disease at the time of check-up.

Table 1. Demographic Characteristics of Study Participants (n = 100)

	Category	Frequency (n) and Percentage (%)
Gender	Male	46
	Female	54
Residence	Urban	58
	Rural	42
Age group (years)	Under 15	4
	15–30	20
	31–45	32
	Over 45	44
Education level	Illiterate	22
	Primary	22
	Secondary	46
	Graduate and above	10

Table 2. Prevalence of Clinical Symptoms among TB Patients

Symptom	Frequency (n) and Percentage (%)
Cough	84
Sputum	66
Hemoptysis	20
Chest pain	68
Shortness of breath	76
Night sweats	84
Weight loss	84
Fever	90
Fatigue	92
Swollen nodes	46

Table 3. Comparison of clinical symptoms among TB patients by residence

Symptom	Urban n (%)	Rural n (%)	χ^2 value	p-value
Cough	24	18	0.36	0.55
Sputum	15	18	6.27	0.012
Hemoptysis (Blood in sputum)	3	7	4.02	0.045
Chest pain	16	18	5.22	0.022
Shortness of breath	19	19	4.16	0.041
Night sweats	22	20	3.40	0.065
Weight loss	24	18	0.08	0.78
Fever	24	21	4.02	0.044
Fatigue	25	21	3.15	0.076
Swollen lymph nodes	12	11	0.59	0.44

Impact of living in crowded area

The results of the investigation showed in table 4 clearly represents a statistically significant link between living in crowded area and coughing. However, there was no statistically significant correlation between residing in a crowded area and any of other symptoms such as hemoptysis, chest pain, shortness of breath, night sweats, weight loss, fever, fatigue and swollen nodes. Although, symptoms like weight loss and night sweats found to be more frequent in people residing in populated areas but these variations are not statistically significant.

Age- related variation in Symptoms

The distribution of symptoms changed significantly with age as shown in table 5. All age groups experienced coughing and sputum production: however compared to younger patients, older individuals (>45 years) showed significantly higher frequency of night sweats (p=0.003), shortness of breath (p=0.015) and chest pain (p=0.020). Hemoptysis and other severe symptoms were less likely in people under 30. Although fatigue, fever, and weight loss were also more frequent in older adults, these differences were not statistically significant. The overall pattern indicates that systemic involvement and respiratory severity increases with advancing age.

Table 4. Comparison of clinical symptoms among TB patients with respect to living in crowded place

Symptom	Living in crowded place (Yes)	Living in crowded place (No)	χ^2 value	p-value
Cough	20	19	6.22	0.013
Sputum	18	15	0.48	0.49
Hemoptysis	6	4	0.02	0.89
Chest pain	20	14	0.03	0.87
Shortness of breath	22	16	0.001	0.98
Night sweats	26	16	1.64	0.20
Weight loss	23	19	1.13	0.29
Fever	26	19	0.01	0.92
Fatigue	27	19	0.11	0.74
Swollen lymph nodes	14	9	0.14	0.70

Table 5. Relationship between Age Group and Selected TB Symptoms (n = 100)

Symptom	15–30 yrs (n=20)	31–45 yrs (n=32)	Over 45 yrs	Under 15 yrs.	χ^2 value	p-value
Cough	14.0%	26%	40%	4%	6.39	0.38
Sputum	10.0%	22%	32%	2%	1.86	0.6
Hemoptysis	0%	10%	8%	2%	4.93	0.17
Chest pain	6%	26%	34%	2%	9.09	0.02
Short breath	8%	24%	40%	4%	10.42	0.015
Night sweats	14.0%	28%	28%	0%	14.25	0.003
Weight loss	18%	28%	36%	2%	2.21	0.53
Fever	6%	26%	44%	4%	5.13	0.16
Fatigue	18%	28%	42%	4%	1.02	0.79
Swollen nodes	8%	12%	24%	2%	1.27	0.73

Relationship between Clinical Symptoms and Smoking

Chest pain was significantly more frequent in smokers (72.2%) compared to non-smokers (42.9%) ($p<0.05$). Smokers also reported greater rates of fever (100%), hemoptysis (100%), cough (90%), and shortness of breath (68.2%), but these differenced were not statistically significant (Table 6). The results imply that smoking worsen some respiratory symptoms, especially chest pain, but has little effect on full range of symptoms.

Table 6. Association between Smoking Habit and Respiratory Symptoms

Symptom	Smokers (n=15)	Non-smokers (n=35)	χ^2 value	p-value
Cough	90%	75%	2.27	0.68
Sputum	20%	46%	0.59	0.74
Hemoptysis	100.0%	14.3%	0.8	0.66
Chest pain	72.7%	42.9%	6.93	0.03*
Short breath	68.2%	35.7%	1.51	0.46
Night Sweats	86.6%	82.8%	4.08	0.12
Weight loss	93.3%	80%	1.63	0.44
Fever	100%	85.7%	2.38	0.3
Fatigue	68.2%	94.2%	1.28	0.52
Swollen Nodes	53.3%	42.8%	0.59	0.74

Relationship between Clinical Symptoms and Alcohol Consumption

Chest pain was also found to be significantly associated with alcohol consumption ($p<0.05$), and reported to be more common in alcoholic patients (95%) than non-alcoholics (100%) (Table 7). Although larger percentages of alcohol consumers reporting fatigue (75%), shortness of breath (85%) and cough (90%), these differences were not statistically significant. Despite its link with other clinical aspects was not statistically verified, this data suggests that alcohol consumption might aggravate respiratory discomfort in TB patients especially chest-related symptoms.

Discussion

Sociodemographic distribution

In the present survey, middle aged, urban and educated people were more likely to be impacted with a slight more prevalence of *Tuberculosis* in females than males. Similar to the present results, no significant gender bias was among the occurrence of TB with 1.4 to 1 ratio of females to males among patients indicating that disease effects male and females equally. (Koul et al., 2016) Moreover, in a study conducted on Pediatric age group also showed maximum prevalence of disease in highest age group (10-16 years) indicating similar findings with middle-ages to be affected most. (Muralidhar et al., 2021). Similar trend of 18-40 years of people being more effected was noticed in a study from Kashmir (Koul et al., 2016)

Clinical Symptom profile

Among respiratory symptoms cough was most prevalent among our study subjects, followed by shortness of breath, chest pain and hemoptysis. Prevalence of cough was highest in other studies as well indicating cough to be the most common and important indicator of Tuberculosis (Singh and Tiwari, 2015; Rao et al., 2012).

Residence

The current study's rural tuberculosis patients had greater rates of fever, hemoptysis, chest discomfort, dyspnea, and sputum production, which may indicate that the disease was more progressed at the time of diagnosis. Similar findings have been observed in Indian research by other authors as well (Rajeshwari et al., 2002; Sruramareddy et al., 2009) which showed that living in a rural area is linked to longer patient and health- system delays as well as delayed health- seeking behaviour, which increases the severity of the disease upon presentation. These findings are corroborated by data from the National TB Prevalence Survey of India (CTB, 2022), which shows that rural populations have a greater prevalence of bacteriologically confirmed pulmonary tuberculosis. According to an author from (Lonnoroth et al., 2009), contributing variables that worsen respiratory symptoms include hunger, indoor air pollution from the use of biomass fuels, and occupational exposure to smoke and dust, which is more common in rural areas. On the other hand, constitutional symptoms such as fatigue, lymphadenopathy, weight loss, night sweats did not differ significantly by place of residence. This is in line with Indian clinical studies reported by (Sharma and Mohan, 2013), which indicate that these features are common throughout disease stages and are less affected by sociodemographic factors.

Table 7. Association between Alcohol and Symptoms

Symptom	Alcoholic (n=20)	Non-alcoolic (n=30)	χ^2 value	p-value
Cough	90%	80%	2.58	0.62
Sputum	75%	60%	1.42	0.49
Hemoptysis	30%	13.3%	3.33	0.18
Chest pain	95%	100%	11.39	0.003*
Short breath	85%	70%	1.75	0.41
Night Sweats	95%	76.6%	3.37	0.18
Weight loss	95%	76.6%	3.37	0.18
Fever	95%	86.6%	1.48	0.47
Fatigue	75%	96.6%	2.89	0.23
Swollen Nodes	100%	43.3%	3.43	0.17

Crowded place

The current findings show a substantial link between living in crowded conditions and the incidence of cough in tuberculosis patients, highlighting overcrowding as an important environmental risk factor impacting early respiratory manifestations of disease. Similar relationships have been observed in Indian research by (Rajeshwari et al., 2002; Muniyadi et al., 2006), who emphasize the importance of dense housing and prolonged interpersonal interaction in enabling airborne transmission. There was no significant relationship found between crowding and other respiratory or constitutional symptoms, such as sputum production, hemoptysis, dyspnea, fever, weight loss, night sweats, fatigue or swollen lymph nodes. This pattern corresponds with evidence from India as reported by (Sharma and Mohan, 2013) as well as national TB prevalence surveys. It indicates that although overcrowded environments facilitate exposure and the onset of early symptoms, the advancement to more severe or systemic manifestations is predominantly determined by host factors, the duration of infection, and prompt access to healthcare, rather than environmental crowding alone.

Age related variation in Symptoms

Chest pain, shortness of breath and night sweats found to be more common in older patients with fatigue, fever and weight loss also be frequent but not statistically significant. Although, no study so far has studied age-related variation in symptoms, however the prevalence of disease recorded to increase with age in some studies (Gothi et al., 1976; NTI, 1974; Datta et al., 2000; Bhat et al., 2009; Rao et al., 2010; Pamra et al., 1973; Gothi et al., 1979; NFHS, 2007).

Smoking association with symptoms

Chest pain was found to be significantly related to smoking with more prevalence of symptom in smokers. Although, other symptoms like fever, hemoptysis, cough and shortness of breath were also found to be more prevalent in smokers, but no significant association was found statistically. In another study conducted to analyse quality of life of patients with post -pulmonary tuberculosis sequelae from AIIMS New Delhi, no significant association of smoking with disease was found (Thoker et al., 2023).

Alcohol and Tuberculosis symptoms

In this case also, chest pain was the only symptom that was found significantly related to alcohol consumption along with other symptoms being more prevalent in alcoholic persons but not statistically significant. Also, only 20 patients consumed alcohol out of 100, in which occasional drinkers were also included, a similar trend of less

involvement (29%). TB patients in alcohol drinking was reported in a study from Chennai (Suhadev et al., 2011). However, no direct relation of alcohol consumption and TB symptoms has been so far studied, there are studies claiming alcohol use and increased the risk of developing TB (Chung et al., 2024).

Conclusion

It can be concluded from the present study that the impact of lifestyle, environmental, and sociodemographic factors on clinical presentation of tuberculosis in 100 patients that Tb was more prevalent in people over 45 (44%), women (54%) and city dwellers (54%). The most commonly reported symptoms were fatigue (92%), fever (90%) and cough (84%), suggesting significant pulmonary and systemic involvement. Sputum production, hemoptysis, chest pain, shortness of breath, and fever considerably more common in rural patients ($p< 0.05$), indicating a delayed diagnosis and more severe illness. Living in crowded conditions was substantially linked to coughing ($p=0.013$), highlighting crowding as a major risk factor for early respiratory symptoms. Chest discomfort, breathlessness, and night sweats were considerably more common in older patients (> 45 years old) ($p<0.05$), indicating that the severity of the condition increased with age. Additionally, there was a substantial correlation between alcohol use and smoking and chest pain. In order to facilitate early detection, focused interventions, and better results in endemic settings, the results highlight the necessity of including environmental exposure, lifestyle choices, and age- related vulnerability into tuberculosis control programs.

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GKW, KB and MPK conceived the concept, wrote and approved the manuscript.

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